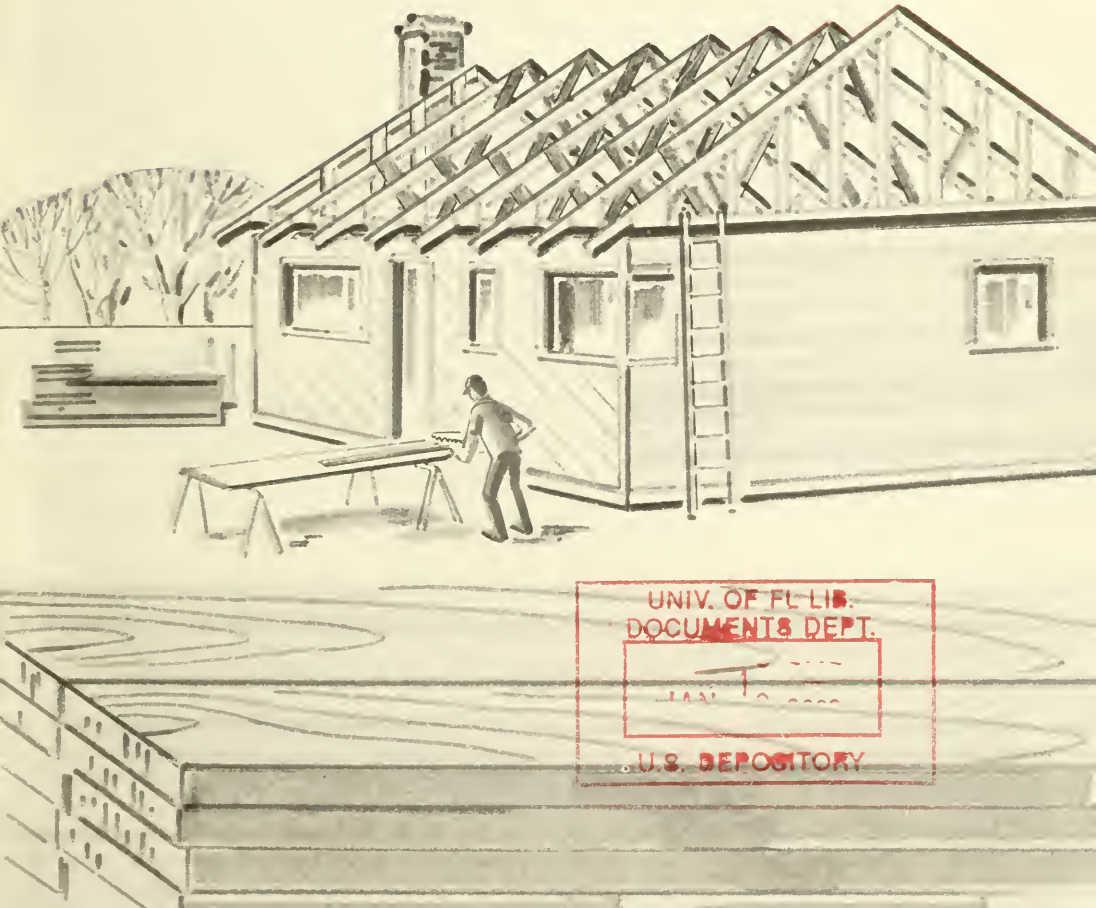
HOUSE CONSTRUCTION

HOW TO REDUCE COSTS



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HOUSE CONSTRUCTION—

How to Reduce Costs

By Jerry O. Newman, *Agricultural Engineering Research Division*, and Norman C. Teter and Constance D. O'Brien, formerly of *Agricultural Engineering Research Division, Agricultural Research Service.*

You're building a house and want to keep down the cost. How can you do it?

First, plan carefully "on paper" before you start construction. By doing so, you can avoid costly mistakes in the building and in the purchase of materials. Careful planning and proper design will reduce not only the initial cost but also the cost of furnishings, utilities, and maintenance.

Second, avoid unnecessary features and expensive "frills." Numerous features found in today's homes could probably be eliminated without sacrificing living comfort or efficiency.

Third, do some of the work yourself. Limit yourself, however, to those jobs that you know you can do. Mistakes can be costly.

Economical construction does not mean inferior construction. Poor workmanship and shoddy materials are not economical in the long run. Maintenance and repair costs could soon nullify any initial savings.

Following are many specific ways to reduce the cost of a house. Your builder may know additional ways. You yourself may have some ideas.

LOCATION

Choose the house site carefully. By doing so, you can avoid future problems that could be expensive to correct. For example, poor soil drainage could lead to a wet or damp basement.

Look for these features:

Firm, well-drained soil.—Avoid poorly drained or unstable land. In some cases, it may be necessary to provide good drainage with tile and ditches. Well-drained sloping sites are ideal for basements.

Good air circulation.—Avoid building in low places where the air may be trapped.

Good accessibility.—Private roads and driveways are expensive to build and maintain.

Availability of public utilities—gas, water, electricity, and sewage disposal.—If the site is not convenient to a public sewer system, make sure that it is suitable for an individual sewage-disposal system. Check with local health authorities. Sewage disposal must be downgrade from the house and well away from the house water supply.

Good orientation.—Can you take advantage of winter sunshine for

warmth and summer breezes for cooling? Large picture windows should face south for maximum sunshine in the winter.

Adequate distance from other buildings.—Winds can carry odors from animal shelters or other buildings.

STYLE OR DESIGN

Design or plan the house to meet your family's requirements. Too-small a house, for example, would be false economy. Here are some principles of economical design:

- Two-story houses cost less per square foot to build than single-story ones. The main reason is that less roof area is required to cover an equivalent amount of living area.
- Rectangular floor plans cost less per square foot to build than L-shaped, U-shaped, or other irregular floor plans.
- Simple gable roofs are the most economical. Flat and shed roofs are cheaper but have poor drainage and high maintenance cost. Ridges and valleys increase the cost of a roof.

Consider Your Future Needs

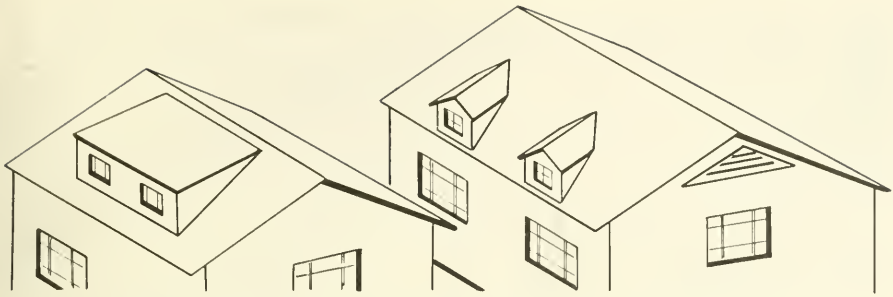
In planning your house, consider your future needs as well as your present. In time, you may need more bedrooms or another bathroom or two.

The space for additional bedrooms can be an unfinished attic or a clean, dry basement. The heating and electrical work can be roughed in.

For future bathrooms, you can rough-in the plumbing in the attic or basement, or in a large walk-in closet.

This additional construction will increase the initial cost of the house, of course. However, it may be more economical in the long run because such work can usually be done cheaper at the time the house is built.

Well-drained, gently sloping sites are ideal for basements. Economical features of this house include the one-story rectangular design and the plain gable roof.



Shed dormers provide more usable space than the gable type.

• Basements add low-cost space to a house. If well lighted, well ventilated, and dry, they can be used for living quarters.

• Attics also add low-cost space. And shed dormers, while they may cost a little more, provide more usable space than gable dormers.

• Slab-on-grade construction is cheaper than crawl-space construction. However, crawl space may be used for utilities equipment such as pumps, furnaces, air conditioners, water tanks, and piping. This will free valuable space in the living area.

• In most climates, large porches are an expensive feature because they provide usable living space only during the warmer months of the year.

INTERIOR ARRANGEMENTS

As with the overall house design, plan the interior arrangements to insure your family's comfort and satisfaction. Yet there are many ways to economize:

• Make rooms multipurpose as far as practical. For example, combine family room and kitchen or family room and dining room.

• Large openings between rooms make small areas functionally larger.

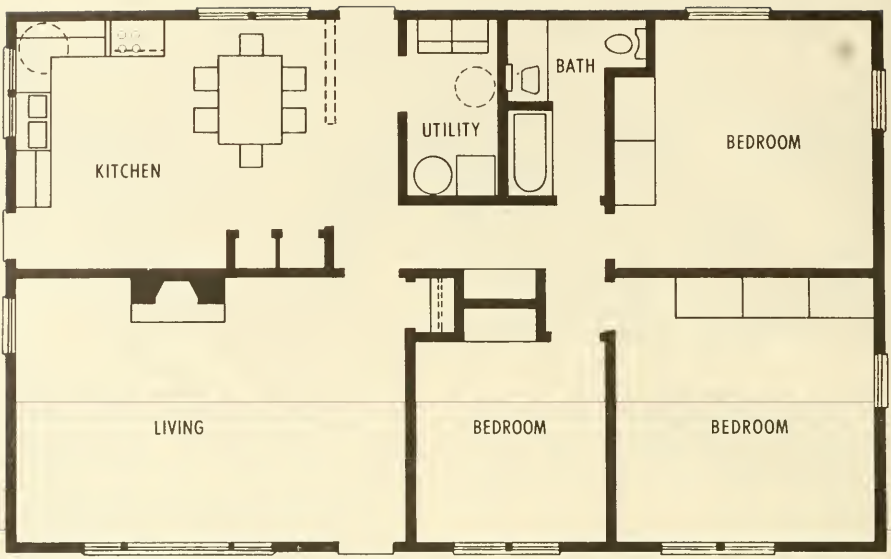
• If room dimensions conform to standard rug sizes, carpet widths, or resilient flooring sizes, you can save a great deal when furnishing and finishing the house. Standard rug sizes, in feet, are 3 x 5, 4 x 6, 6 x 9, 9 x 12, 8 x 10, 10 x 14, and 9 x 15. Carpets are sold by the square yard. Standard widths are 12 and 15 feet.

• Limit hallway space to what is necessary for good traffic circulation. Hallways that include built-in storage and laundry equipment areas become multipurpose.

Kitchens

A good kitchen can be designed for a limited space. In fact, small kitchens can be more efficient than larger ones. In an efficient kitchen, the work areas and equipment are arranged for use in a step-saving manner.

• Make maximum use of the space in an economy kitchen. For example, you can install an under-counter hot-water heater in an otherwise unusable corner base cabinet. Or, you can turn the un-



Rectangular floor plans are the most economical. Other economical features of this arrangement are the combination kitchen and dining area and the compact utility room.

usable corner space into a convenient "passthrough" to the adjoining dining room.

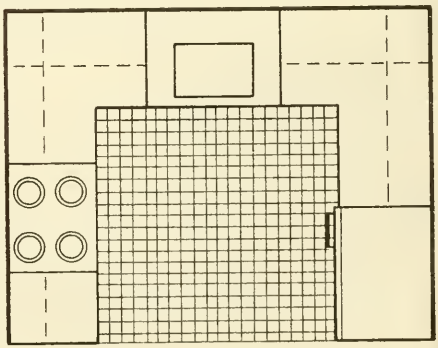
• Plan storage carefully, keeping cabinet space to a necessary minimum. Seldom-used items may be stored on top of cabinets or in the attic or basement. Leave adequate space for any cabinets you plan to add later.

• Both wood cabinets and metal cabinets come in a wide range of prices. However, if well made, custom-built cabinets may be more economical in the long run. Cabinets that are to be painted may be made of less-expensive wood.

• Open shelves are cheaper than cabinets. Closures can be added later.

• Use standard-size cabinets, countertops, and appliances. Custom-built cabinets should conform to the 3-inch kitchen module sizes (6-, 9-, 12-inch, etc.) to facilitate later additions to or remodeling of the kitchen.

• Conventional ranges take up less space than separate eyelevel oven and countertop range units. And they are cheaper when you add the cost of cabinets to contain



U-shaped kitchens are very efficient arrangements.

Maximum use is made of the space in this kitchen.

the separate units to the cost of the units themselves.

• Single-bowl sinks cost less than double-bowl ones and take up less space. Porcelain sinks are the cheapest type.

Bathrooms

Bathroom facilities may be full bath, half bath (lavoratory and toilet), or lavatory or shower only.

• For the most compact, efficient, and economical fixture and plumbing arrangement in a bathroom, install all of the fixtures along one wall.

• For the most economical plumbing arrangement, install two bathrooms one above the other or back to back.

• Well-planned compartmented, or divided, bathrooms cost less and take up less space than two separate bathrooms. With the tub and toilet in one section and one or two lavatories in the other, two or three persons can use the bathroom at the same time.

• Utilize the space above the toilet (water closet) for storage cabinets for bathroom linens and supplies.

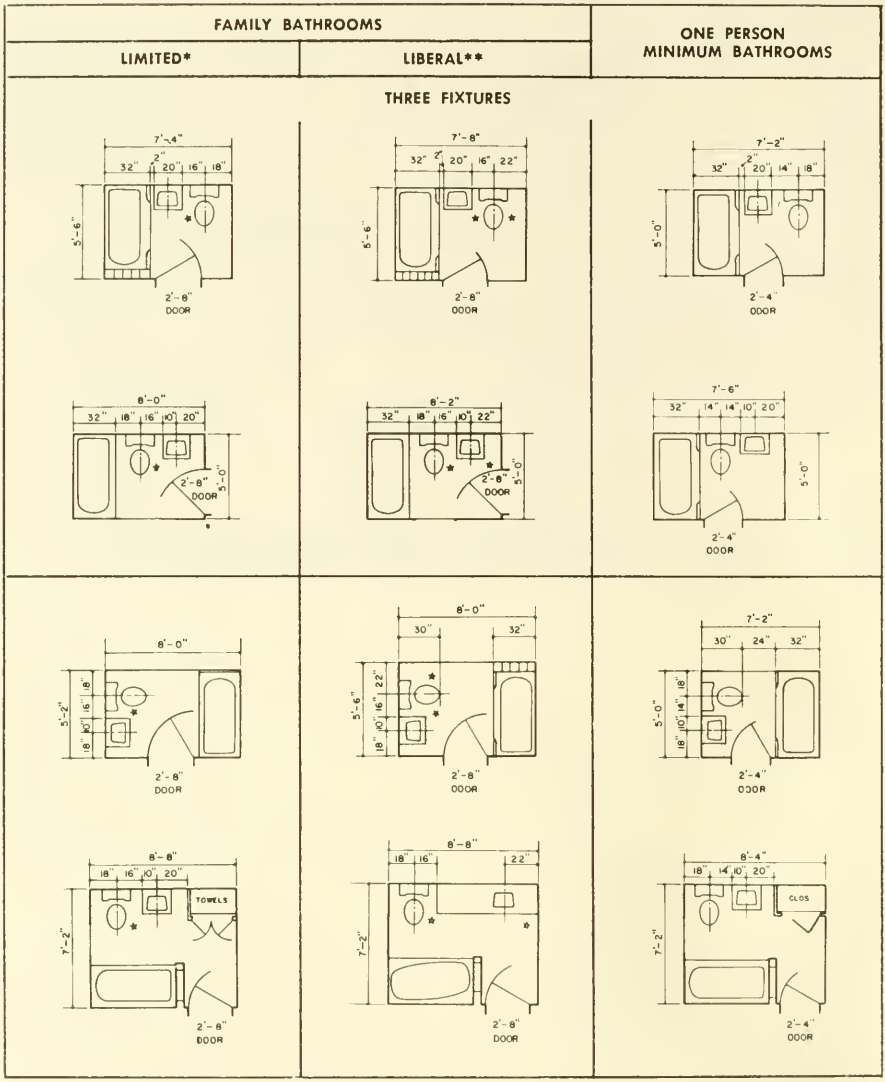
Laundry

Laundry equipment should be in a convenient but inconspicuous place:

• Basements or utility rooms in basementless houses are the favorite locations for washers and dryers.

• Combination washer-dryer units or stacked washer and dryer units take up less floor space than separate units.

• In warm climates, washers and dryers might be located in the carport or garage. This is relatively "cheap" space and more convenient to outdoor drying lines should they



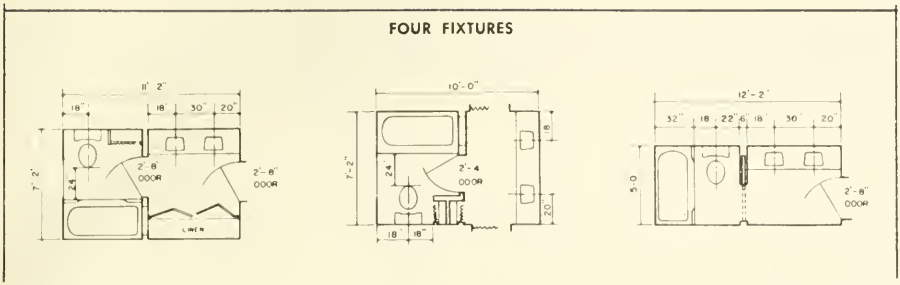
Many different bathroom arrangements are possible. In the top group, all fixtures and plumbing are along one wall. This is the most economical arrangement. Fixtures and plumbing are along two walls in the bottom group.

be needed. Also, you save in the cost of venting the dryer.

Storage

Attics and basements (dry ones) provide good storage space. But you also need more convenient "everyday" storage room:

• Storage walls may be used in lieu of conventional walls. You can buy them as assembled or ready-to-assemble units, or you can build your own. They help buffer sound



Compartmented bathrooms are more economical than two separate bathrooms.

between rooms as well as provide storage space.

• Use well-planned closets. Make them no deeper than necessary. Unless arranged as "walk-ins," deep, dark closets waste space.

• Make walk-in closets wide enough for storage on both sides. Single hung doors are satisfactory for these closets.

• Gain space by installing hooks, racks, or shelves on the back of closet doors.

SELECTION OF MATERIALS

Your builder may buy most of the materials, but you mainly decide what to use. Mutual agreement on the type of materials, the sources, and the prices is necessary. Here are some general ways to economize:

• Buy locally to avoid shipping charges and in quantity to avoid the higher cost of small deliveries.

• Buy stock materials in standard sizes.

• Buy the cheaper material when it will do the job satisfactorily. Never compromise, however, on the quality of plumbing fixtures and fittings; light switches; furnaces, pumps, and other mechanical items subject to wear; paint; and lumber.

• Shop around to get the most for your money. Check independent performance ratings of materials and equipment. Take advantage of sales and pre-season promotions.

• Know what materials you need and where you can substitute should you find a bargain.

• Limit the number of different types of materials used. This will reduce waste and save on construction costs.

Walls

• Walls made of materials that form both the exterior and interior wall surface are more economical than composite walls (several layers of material) of similar quality. For one thing, they may require less labor to build. Concrete block walls are a good example.

• Large-dimension wall units save time and labor. For example, 8- by 16-inch concrete blocks go up faster than 2- by 8-inch bricks. Or, 4- by 8-foot sheets of plywood go up faster than sheathing.

• Use insulation board instead of sheathing where it will be strong enough to resist the wind load and support the other loads that it must.

• Prefinished wood, hardboard, and gypsum wall paneling are rela-

tively expensive. But they are easy to install and require no finishing which saves time and labor and helps offset the higher cost.

Floors

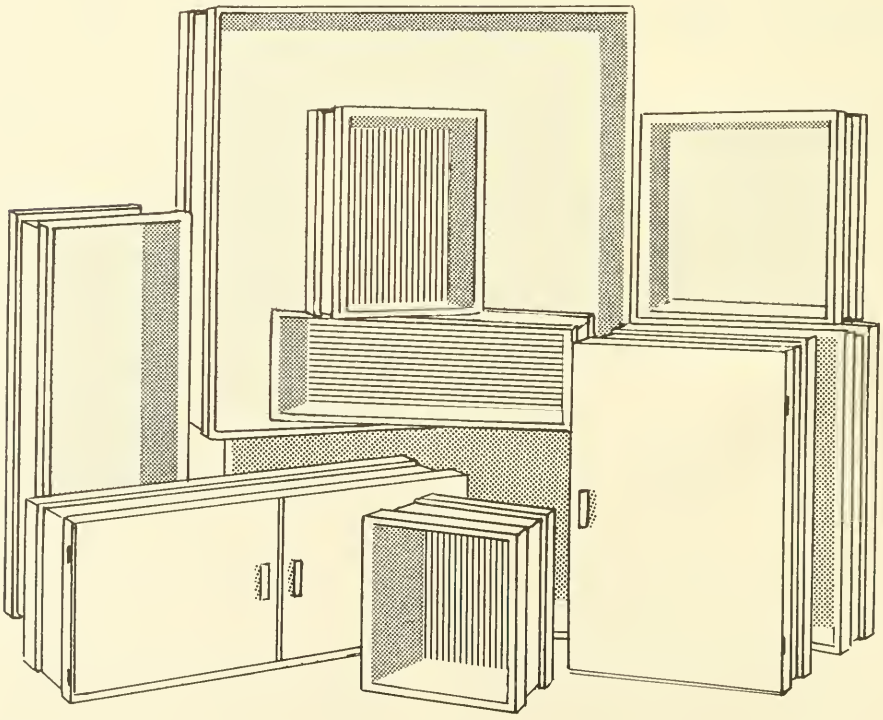
Hardwood floors are economical over a long period of time, but their initial cost is high—both to buy and to install. And prefinished wood flooring is even more expensive, although the time and labor saved by not having to finish the flooring helps to offset the additional cost. You should consider using tile flooring or carpeting instead of finished hardwood floors, especially for long service.

• Thick tile flooring costs more than the thinner type, but it lasts longer. It may be more economical in the long run for areas of high wear such as the kitchen and hallways.

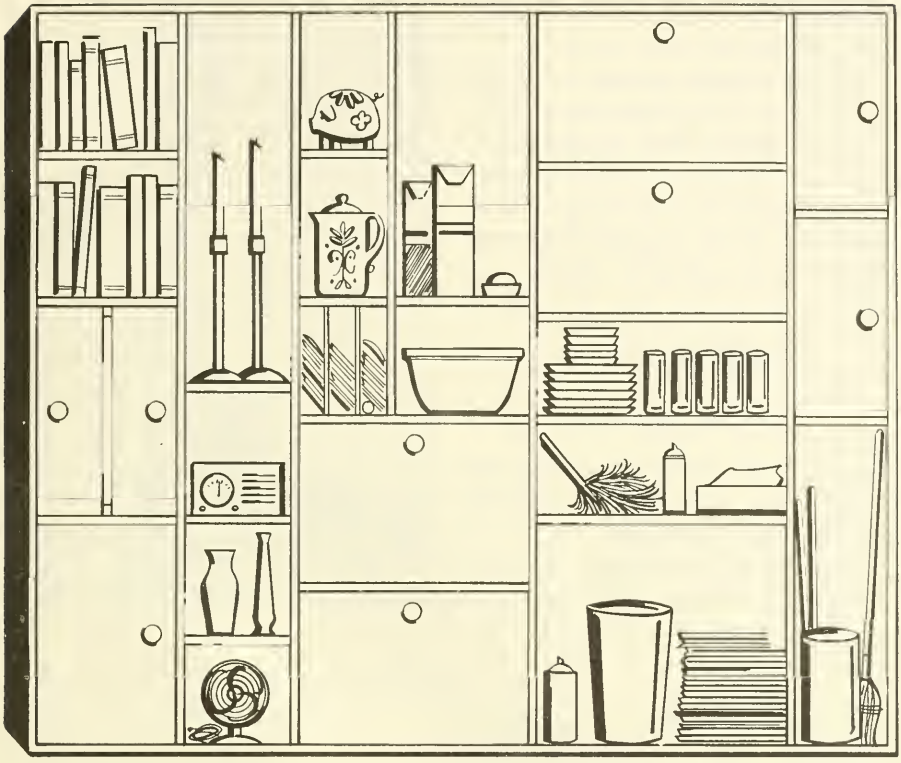
• Dark-colored tile costs less than the lighter colors. Dark asphalt tile is the cheapest type. It is satisfactory for use in all areas except the kitchen. Asphalt tile coated with a plastic film should be used there.

• Vinyl asbestos tile and sheet vinyl floor coverings, which are comparable in cost to light asphalt tile, are favored for general use in low-cost housing. Vinyl asbestos and asphalt tile may be used for basements or ground-level floors.

• The new indoor-out-door-type carpeting is easy to install and to



Storage walls, which may be used in place of conventional walls, come as ready-to-assemble units.



Assembled storage wall units can accommodate a variety of items.

maintain. While it may be slightly more expensive than regular carpeting, it is also more durable.

Fireplaces

Fireplaces are neither an efficient nor an economical source of heat. One may be too much of an expense unless you use cheaper materials and do much of the work yourself.

• Stick to a simple design. Raised hearths, mantels, and decorative molding are attractive but unnecessary features.

• Prefabricated fireplaces and chimneys are cheaper than masonry ones.

Windows and Doors

• Buy standard-size window and door frames from mill stock.

• Factory-assembled window units ready to drop into rough openings save labor.

• For large window areas, prefabricated window walls may be used. These consist of a wall, frame, window frame, sash, and an integral exterior trim.

• Consider standard ready-made-drapery measurements when choosing window sizes; custom-made draperies are expensive. Standard drapery lengths are 36, 45, 54, 63, 72, 81, 84, and 90 inches. Standard

pleated widths per pair are 4, 6, 8, and 12 feet.

• Double-track storm windows are cheaper than triple-track ones.

• Door prices vary considerably depending on the material and quality. Consider factory-hung doors, especially if an experienced door hanger is not readily available.

CONSTRUCTION

Handling Materials

Keep the handling of materials to a minimum. This will save labor and speed up the work:

• Schedule deliveries to correspond with the work progress.

• Unload and stack or pile the materials as close as possible to the place of use.

• Stack lumber in separate piles according to the sequence of use. If space is limited, stack it in one or two piles with that to be used first on top.

Wide, shallow closets are convenient for storing frequently used items. Note the additional storage provided on the wide-opening, double-hung doors.

Prefabricated fireplaces usually cost less and heat more efficiently than comparable size masonry fireplaces.

• Lift materials into place by means of a front end loader on a tractor or other such equipment when possible.

Working Tips and Precautions

To speed up the work and prevent personal injury—

• Avoid working on your knees and tiptoes. These positions are uncomfortable, time-consuming, and dangerous.

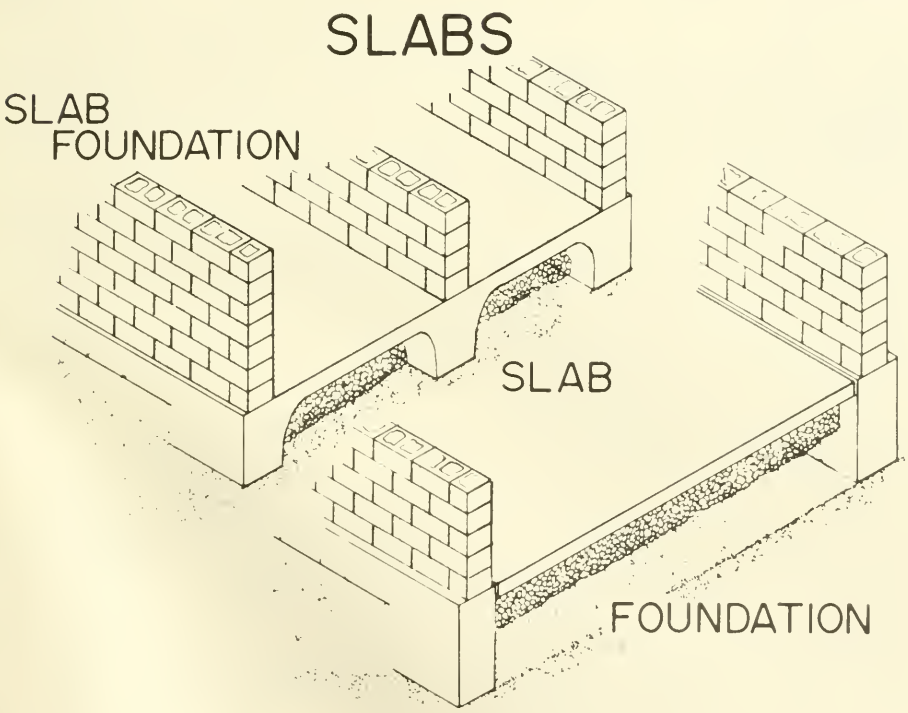
• Avoid working on ladders and scaffolds. If necessary to do so, be sure the ladder or scaffold is secure and stable.

• Keep scrap and debris clear of the working area. Clean up after each day's work.

Construction Practices

These construction practices can speed up the work, save labor, and reduce costs. All may not be applicable to your house, however.

- Grade and stone the driveway before you start construction of the house. It will be convenient for making deliveries of materials and for getting to and from the site in bad weather.
- Place all utilities before you pour the concrete slab in slab-on-grade construction.
- Install all utilities before you enclose and finish walls and floors.
- Place drains and sewers before you pour the foundation footings.
- Fabricate trusses and gable ends on the ground where a jig can be used to speed up the job and improve workmanship.
- Build the wall panels on the platform of the house.
- Omit non-load-bearing partitions until after you finish the floors and ceilings. You can then install the flooring and ceiling in two or more rooms at one time and save some cutting and fitting of materials.
- In crawl space construction, floor joists generally span about half the width of the house with the ends near the center of the house supported by a beam. Shorter spans will allow the use of smaller joists.



Foundations must be carefully designed to avoid uneven settlement of the house or other trouble. Increasing the thickness of the concrete slab under load-bearing walls (top) saves pouring separate footings.

Support the joists with two or three beams. However, don't spend more on beams than you save on joists.

• In concrete-slab construction, increase the thickness of the slab under load-bearing walls instead of pouring separate footings.

• Design to meet the minimum structural standards for loads set by the Federal Housing Administration (FHA) or local building codes. FHA standards, which correspond to most of the predominant building codes, are:

	Pounds per square foot
Exterior walls	20
Interior walls	15
Steep roofs	15
Low-pitched roofs	20
Flat roofs	40

• Design to meet maximum code deflection. FHA standards are:

Rafters	1/180 of span or 1 inch maximum
Floor joists	1/360 of span or ½ inch maximum
Ceiling joists	1/240 of span or ¾ inch maximum
Girders	1/360 of span or ½ inch maximum

• Have the structural strength required for foundation walls calculated by a well-qualified person. Considerable material can be saved if a thinner wall will be strong enough.

• Design the foundation and footings carefully. Too often chimney or column footings support a heavier load per square foot than sidewall footings. This causes uneven settlement of the house which in turn causes cracks. Size the footings in proportion to their load—large footings for heavy loads and smaller footings for lighter loads.

• Wall studs may be placed 24 inches on center instead of the usual 16 inches, if building codes permit.

• Allow beams to be continuous across supports. If two beams meet over a center support, overlap them and fasten them together securely. While this will not strengthen the beam appreciably, it will reduce beam deflection (make the beam stiffer).

• Allow beams to overhang their supports when possible. This will create a balancing force on the beam and reduce deflection of the intermediate spans. It will also decrease the intermediate beam span (making it stiffer).

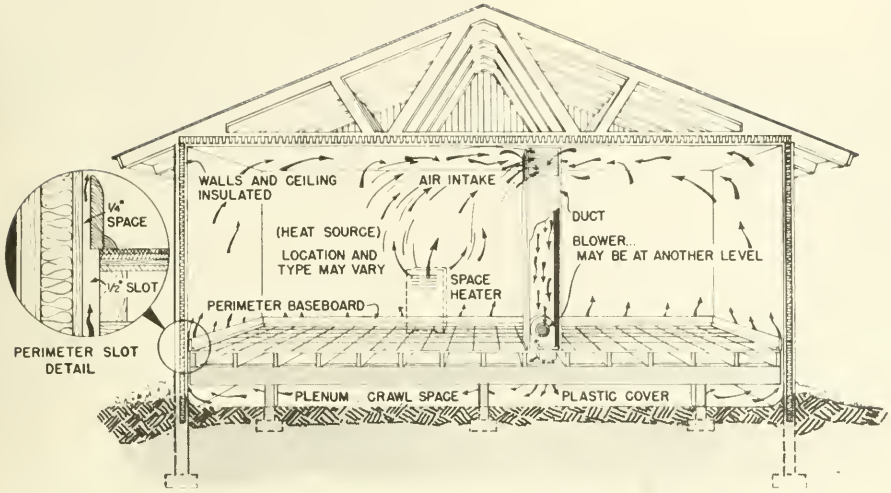
• Wall sheathing is not required if the structure is strong enough to resist the racking of a 20-pound-per-square-foot wall load. A racking load is one that acts parallel to the wall.

UTILITIES

Economy is possible not only in the installation of utilities but also in the operation.

Heating, Cooling, and Ventilating

• In basementless houses, central heating and cooling equipment may be installed in an attic or crawl



AIR DIFFUSION SYSTEM USING UNDER-FLOOR PLENUM WITH PERIMETER SLOT

The peripheral circulation type heating system is economical for one-story houses with crawl space.

space to free space in the living area.

• Large windows facing north and south are cooler than those facing east and west. And with windows facing south, you receive more winter sunshine. This helps keep the house warm.

• Light-colored roofing materials absorb much less of the sun's heat than darker materials. This keeps the house cooler.

• Shade the house against direct rays of the sun with trees, awnings, and other natural or artificial shading. This too will keep it cooler.

• Black-top or concrete areas adjacent to a house reflect or radiate solar heat into the house. This makes it harder to keep the house cool.

• A hood and blower unit over the range or oven is a good way to ventilate a kitchen, although wall and ceiling fans may be less expensive. If the range or oven is along an outside wall, it will be cheaper to exhaust through the wall instead of the roof.

• Attic fans provide good ventilation at relatively low cost.

• Install air-duct systems with as few turns as possible. Turns create resistance to air flow and thus reduce effective heat distribution.

• Pipeless furnaces are more economical for houses with crawl space than furnace-and-duct systems.

• The peripheral circulation type heating system is especially adapted to one-story houses with crawl space. It is illustrated in the drawing above, and described in USDA Production Research Report 99, "Economical and Efficient Heating System for Homes." To obtain a copy of the report, see the box on the next page.

• Concentrate plumbing fixtures as much as possible to reduce the amount of piping required. In a two-story house, "stack" the fixtures—locate the bathroom directly above the kitchen or a downstairs bathroom with all fixtures on the same wall. Or, in a single-story house, locate the kitchen and bathroom or kitchen and laundry room back to back with the fixtures back to back.

• Install an electric water heater in an area not suitable for other use. For example, you might put it under a stairway, in the crawl space, or in a corner base cabinet in the kitchen.

• Automatic washers, dishwashers, and garbage disposals increase the load on a septic tank. Too small a tank will need more frequent cleaning. It is much cheaper to install a large tank at the time of construction than to replace an inadequate system later on.

Wiring and Lighting

Never compromise on the quality or safety of your electric wiring. Installation by an experienced electrician is recommended and may be required in many areas. In all cases, have the wiring inspected.

• Install adequate outlets and switches. Wire for your future needs as well as your present.

• Switch-controlled outlets may be installed instead of ceiling fixtures. This is more practical if you already have lamps. If you have to buy lamps, it might be more expensive.

• Omit lights in closets where hallway or room lights will provide sufficient light.

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F 1869, Foundations for Farm Buildings

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F 2227, Fire-Resistant Construction of the Home . . . of Farm Buildings

F 2235, Home Heating

G 100, Equipment for Cooling Your Home

M 1006, 3-Bedroom Farmhouse—Masonry Construction, Plan No. 7170

M 1011, 3-Bedroom Farmhouse—Slab on Grade, Plan No. 7167

These publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at the price indicated.

M 1020, A House-Farming System for Low-Cost Construction (15 cents)

PRR 99, Economical and Efficient Heating System for Homes (20 cents)

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